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(30) Priority: **12.06.2015 JP 2015119672**
12.06.2015 JP 2015119673

(54) **PIEZOELECTRIC DRIVING DEVICE FOR MOTOR, MOTOR, ROBOT, AND PUMP**

(57) Provided is a piezoelectric driving device 100 for a motor 101 including: a vibrating plate 40 which includes a fixed portion 42 and a vibrator portion 46 in which a piezoelectric element 50 is provided and which is supported by the fixed portion; and a contact portion 60 which comes into contact with a driven body 2 and transmits motion of the vibrating plate to the driven body, in which the fixed portion, the vibrator portion, and the contact portion are provided along an X direction in this order, when seen in a Y direction, when two directions parallel to a main surface of the vibrating plate and orthogonal to each other are set as the X direction and the Y direction and a direction orthogonal to the main surface of the vibrating plate is set as a Z direction.

FIG. 1

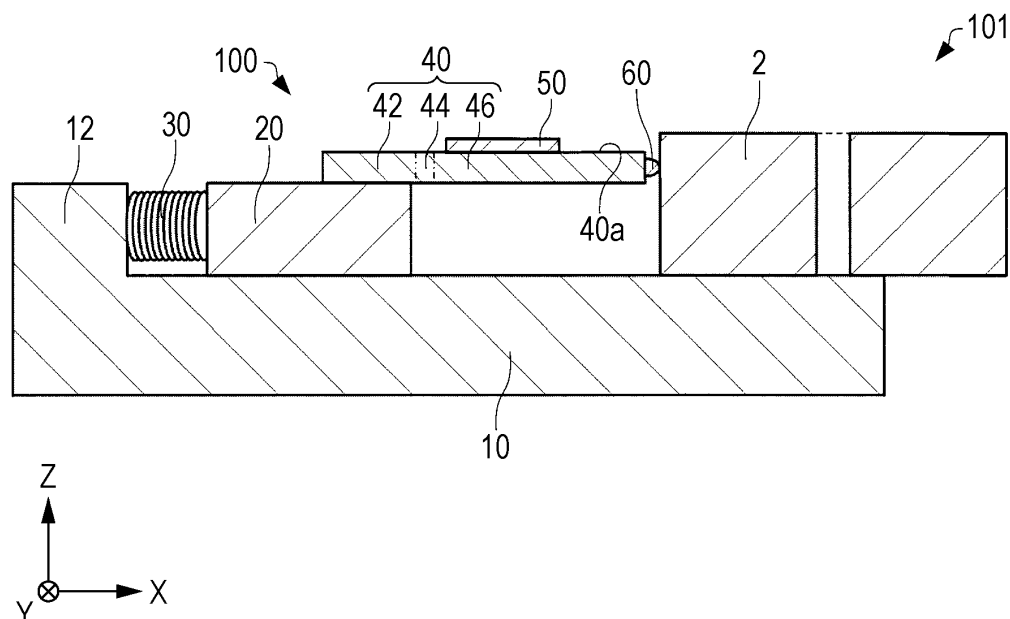
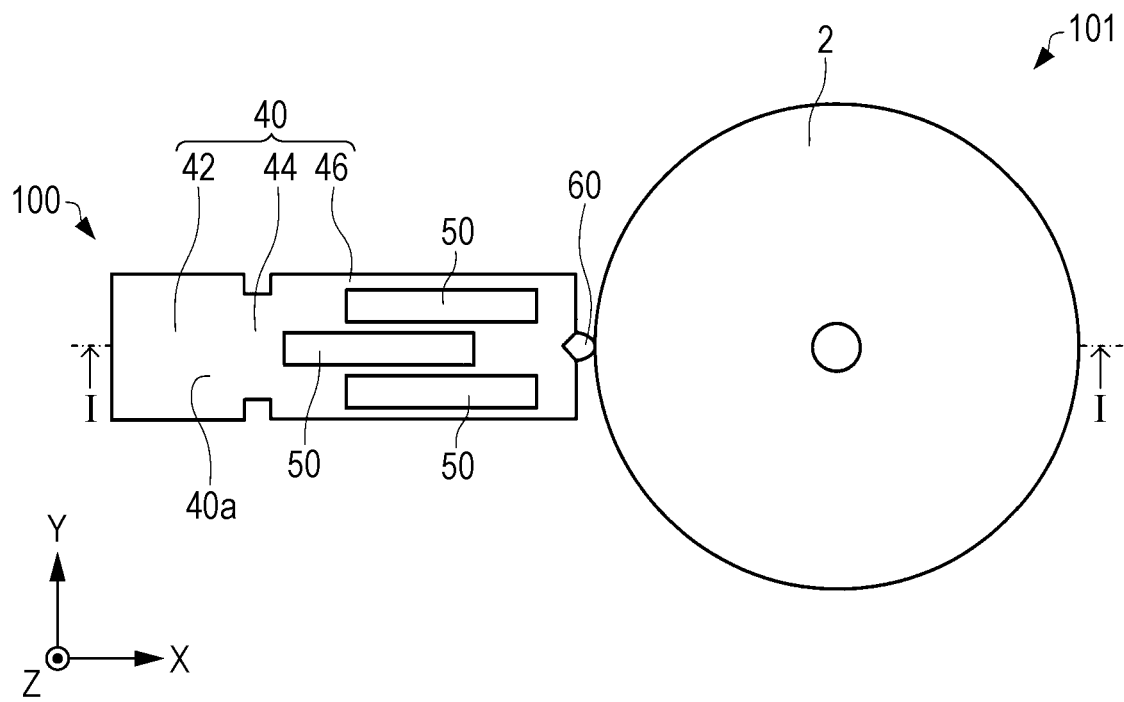


FIG. 2





PARTIAL EUROPEAN SEARCH REPORT

Application Number

under Rule 62a and/or 63 of the European Patent Convention.
This report shall be considered, for the purposes of
subsequent proceedings, as the European search report

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP H09 135585 A (NIPPON KOGAKU KK) 20 May 1997 (1997-05-20)	1,3,12	INV. H01L41/09
Y	* abstract * * paragraphs [0005], [0006], [0022] - [0032], [0043] - [0052]; figures 1,2,5,6 *	2,4,5, 13,14	B25J9/12 F04B43/09 H02N2/10 H02N2/00
X	----- US 2013/140951 A1 (KAMIJO KOICHI [JP] ET AL) 6 June 2013 (2013-06-06)	1,12,13	
Y	* abstract * * paragraphs [0052] - [0133]; figures 10-13 *	13	
Y	----- US 2014/015381 A1 (KIKUSHIMA MASAYUKI [JP]) 16 January 2014 (2014-01-16)	2,5	
	* abstract * * paragraphs [0049] - [0063], [0091] - [0098]; figures 1,2,5 *		
Y	----- JP 2003 008094 A (SEIKO INSTR INC) 10 January 2003 (2003-01-10)	5	
	* abstract * * paragraphs [0003], [0024], [0048]; figures 9,1 *		
	----- -/--		
INCOMPLETE SEARCH			TECHNICAL FIELDS SEARCHED (IPC)
The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC so that only a partial search (R.62a, 63) has been carried out.			
Claims searched completely :			
Claims searched incompletely :			
Claims not searched :			
Reason for the limitation of the search: see sheet C			
Place of search		Date of completion of the search	Examiner
Munich		26 June 2017	Lang, Thomas
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (P04E07)



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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (IPC)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
X	JP 2007 202398 A (SEIKO INSTR INC) 9 August 2007 (2007-08-09)	1,3,4, 12,13	
Y	* abstract * * paragraphs [0012] - [0021], [0074] - [0084], [0086] - [0105], [0123]; figures 1-3,8,10 *	14	
Y	----- US 5 616 980 A (ZUMERIS JONA [IL]) 1 April 1997 (1997-04-01) * abstract * * column 9, lines 35-41; figure 7 *	4	
Y	----- US 2014/294607 A1 (MIYAZAKI HAJIME [JP]) 2 October 2014 (2014-10-02) * abstract * * paragraphs [0045] - [0055]; figure 4 *	14	TECHNICAL FIELDS SEARCHED (IPC)

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EPO FORM 1503 03.82 (P04C:10)

**INCOMPLETE SEARCH
SHEET C**

Application Number

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Claim(s) completely searchable:
1-5, 12-14

Claim(s) not searched:
6-11

Reason for the limitation of the search:

The search has been restricted to the subject-matter indicated by the applicant in his letter of 6.1.2017 filed in reply to the invitation pursuant to Rule 62a(1) EPC; i.e. claim 1 and its dependent claims insofar they are unitary (see supplementary sheet B). Contrary to the applicant's opinion expressed in his letter dated 6.1.2017, claim 6 is not de-facto dependent on claim 1: A "base portion" (claim 6) is not necessarily the same as a "fixed portion" (claim 1). Even if the term "base portion" in claim 6 were replaced by "fixed portion", however, such an amended claim 6 would still not contain the feature of claim 1 that "the fixed portion, the vibrator portion, and the contact portion are provided along an X direction in this order". Thus, claim 6 is a truly independent claim, and the applicant's request to search - in addition to claim 1 - claim 6 and the claims 7-11 dependent thereon cannot be followed.



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-3, 5, 12, 13

A piezoelectric driving device for a motor comprising: a vibrating plate which includes a fixed portion and a vibrator portion in which a piezoelectric element is provided and which is supported by the fixed portion; and a contact portion which comes into contact with a driven body and transmits motion of the vibrating plate to the driven body, wherein the fixed portion, the vibrator portion, and the contact portion are provided along an X direction in this order, when seen in a Y direction, when two directions parallel to a main surface of the vibrating plate and orthogonal to each other are set as the X direction and the Y direction and a direction orthogonal to the main surface of the vibrating plate is set as a Z direction (claim 1); wherein a terminal electrically connected to electrodes of the piezoelectric element is provided in the fixed portion (claim 2).

2. claim: 4

The piezoelectric driving device for a motor according to claim 1, wherein a plurality of the vibrating plates are stacked in the Z direction.

3. claim: 14

A pump comprising the piezoelectric driving device for a motor according claim 1; a tube which transports liquid; and a plurality of fingers which close the tube by driving the piezoelectric driving device for a motor.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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26-06-2017

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